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(72) Inventors; and

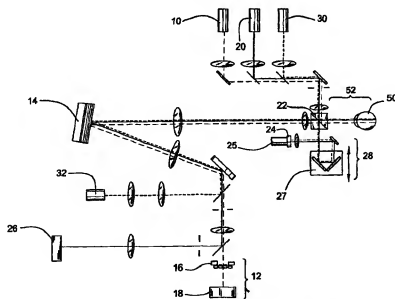
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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR IMPROVING BOTH LATERAL AND AXIAL RESOLUTION IN OPHTHALMOSCOPY



(57) Abstract: The invention provides a method of optical imaging comprising providing a sample to be imaged, measuring and correcting aberrations associated with the sample using adaptive optics, and imaging the sample by optical coherence tomography. The method can be used to image the fundus of a human eye to provide diagnostic information about retinal pathologies such as macular degeneration, retinitis pigmentosa, glaucoma, or diabetic retinopathy. The invention further provides an apparatus comprising an adaptive optics subsystem and a two-dimensional optical coherence tomography subsystem.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/18511

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61B3/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|---|
| X | WO 00 59368 A (DUBOIS ARNAUD; LENA PIERRE (FR); BOCCARA CLAUDE (FR); LE GARGASSON) 12 October 2000 (2000-10-12) | 1-6, 8-11,19, 20, 22-26, 28,30-34 27,35,40 7,12-17, 29,36-38 |
| A | page 3, line 29 -page 4, line 21 | |
| Y | page 13, line 1 - line 11; claims 4,6 | |
| Y | EP 0 659 383 A (HUMPHREY INSTRUMENTS INC) 28 June 1995 (1995-06-28) column 5, line 31 - line 48 column 8, line 1 - line 4 | 7,16,17, 29,37,38 |

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *O* document referring to an oral disclosure, use, exhibition or other means
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T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

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22.12.2003

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/18511

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 21
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Diagnostic method practised on the human or animal body
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/SA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-11,16-20,22-35,37-41*

Method and system for OCT comprising flood illumination

2. Claims: 12-15,36

Method and system for OCT comprising tracking axial motion

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/18511

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| Y | WO 99 65431 A (SAARLOOS PAUL PHILLIP VAN; LIONS EYE INST AUSTRALIA INC (AU)) 23 December 1999 (1999-12-23) page 1, line 3 - line 11 page 8, line 2 - line 25 ----- | 12-15, 36 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/18511

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|----------------------------|---------------------|
| WO 0059368 | A | 12-10-2000 | FR 2791548 A1 | 06-10-2000 |
| | | | AT 227955 T | 15-12-2002 |
| | | | AU 766296 B2 | 16-10-2003 |
| | | | AU 3664300 A | 23-10-2000 |
| | | | BR 0009455 A | 08-01-2002 |
| | | | CA 2366763 A1 | 12-10-2000 |
| | | | CN 1349392 T | 15-05-2002 |
| | | | DE 60000827 D1 | 02-01-2003 |
| | | | DE 60000827 T2 | 09-10-2003 |
| | | | DK 1164921 T3 | 17-03-2003 |
| | | | EP 1164921 A1 | 02-01-2002 |
| | | | ES 2184706 T3 | 16-04-2003 |
| | | | WO 0059368 A1 | 12-10-2000 |
| | | | 2002540829 T | 03-12-2002 |
| | | | PT 1164921 T | 31-03-2003 |
| | | | US 6588900 B1 | 08-07-2003 |
| | | | ZA 200108075 A | 06-08-2002 |
| EP 0659383 | A | 28-06-1995 | US 5537162 A | 16-07-1996 |
| | | | DE 69432395 D1 | 08-05-2003 |
| | | | EP 0659383 A2 | 28-06-1995 |
| | | | JP 8098813 A | 16-04-1996 |
| WO 9965431 | A | 23-12-1999 | AU 750778 B2 | 25-07-2002 |
| | | | AU 4589799 A | 05-01-2000 |
| | | | WO 9965431 A1 | 23-12-1999 |
| | | | CA 2334825 A1 | 23-12-1999 |
| | | | CN 1305360 T | 25-07-2001 |
| | | | EP 1087736 A1 | 04-04-2001 |
| | | | JP 2002518093 T | 25-06-2002 |
| | | | NZ 508729 A | 26-09-2003 |